/841224.sch
Message 2:
From spo_patent@spo.eds.com Fri Sep 4 11:43:43 EDT 1998
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From: spo_patent@spo.eds.com
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by mail1.uspto.gov (8.8.8/8.8.8) with SMTP id LAA04280
for <mayasyst@shell1.uspto.gov>; Fri, 4 Sep 1998 11:50:48 -0400 (EDT)
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id KAA20338 for mayasyst@shell1.uspto.gov; Fri, 4 Sep 1998 10:45:41 -0500
Received: from spo.spo.eds.com by spo1.spo.eds.com (4.1/SPOUUCP-2.4)
id AA08713; Fri, 4 Sep 1998 10:37:52 CDT
Received: from spo4.spo.eds.com by spo.spo.eds.com (4.1/SPO-2.6)
id AA20540; Fri, 4 Sep 1998 10:37:50 CDT
Date: Fri, 4 Sep 1998 10:37:48 CDT
Message-Id: <199809041537.AA23718@spo4.spo.eds.com>
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To: mayasyst@shell1.uspto.gov
Sender: spo_patent@spo.eds.com
Subject: Re: 841224.sch
X-Mailer: SPO Mail
Mime-Version: 1.0
X-Spo-Ctl-Id: <19980904_103154_spo_20352>
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Status: RO

CUSTOMER REQUEST SUMMARY

Your request was:

>e003
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>Word frequency list for document 841224
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> 2 above 1 abstract
> 2 accordance 1 accumulate
> 1 achieved 1 across
> 1 additional 1 additionally
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> 3 adversely 1 alleviated
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> 3 also 1 alters
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> 8 are 1 area
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> 3 axis 1 background
> 1 basic 1 becomes
> 1 been 3 below

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> 1 brief	1 but
> 6 can	2 charge
> 1 charges	2 charging
>17 comb	1 commonly
> 1 conduct	1 conducting
> 1 constructed	1 construction
> 1 control	2 cost
> 1 coupling	1 cross
> 1 degrade	2 depth
> 1 described	2 description
> 1 detailed	1 dielectric
> 1 directly	1 disclosed
> 1 dissolved	1 dissolving
> 2 distance	1 drawing
> 7 drive	2 drives
> 2 effect	1 effected
> 3 effectively	5 effects
> 1 efficient	1 electrical
> 3 electrode	17 electrodes
> 1 electronics	2 electrostatic
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> 1 excitation	1 exert
> 1 experimentation	1 exposed
> 1 fairly	1 features
> 1 field	4 fig
> 1 figs	1 first
> 1 flexure	1 following
> 2 for	5 force
> 3 forces	8 fork
> 2 formed	2 forming
> 1 found	5 from
> 1 fully	1 gagn
> 2 gagnebin	1 gagnebw
> 4 gap	4 glass
> 7 gyroscope	5 gyroscopes
> 2 has	1 having
> 1 hayd	1 high
> 1 however	1 impart
> 1 impractical	1 improve
> 2 improved	1 imurgin
> 1 include	2 increased
> 4 increasing	2 induced
> 1 inner	1 intended
> 1 interact	9 interleaved
> 8 invention	2 known
> 1 larger	4 lift
> 1 line	1 ling
> 1 loop	1 magnitude
> 1 mass	5 masses
> 1 may	2 micromechanical
> 5 microns	1 modest
> 2 more	1 motion
> 2 motor	1 movement

> 1 nchurgin 2 normal
> 1 now 2 off
> 1 offer 1 offs
> 1 operation 2 oscillator
> 3 other 1 out
> 1 outer 1 parallel
> 1 partially 2 particularly
> 6 performance 1 permits
> 1 perpendicular 3 pick
> 2 plan 1 plane
> 1 portions 1 position
> 4 present 1 prevent
> 1 process 1 processes
> 6 proof 1 provide
> 1 provides 1 qmjrgin
> 2 ratio 6 reduce
> 2 reduced 1 related
> 1 relative 1 relatively
> 1 resistivity 1 responsible
> 2 result 1 rgin
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> 1 sensed 2 sensitive
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> 3 silicon 1 situation
> 2 stability 2 starting
> 1 subsection 19 substrate
> 3 such 1 summary
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> 2 tel 1 temperature
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> 2 this 1 through
> 2 transient 6 transients
> 2 trench 11 trenches
> 8 tuning 1 two
> 1 typically 1 understood
> 4 undesirable 2 used
> 2 using 2 vertical
> 3 view 7 voltage
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Sales Order Summary:
Customer ID: 12310
Sales Transaction Nbr: 155220
Date Posted: September 4, 1998
Product: E003
Quantity: 50

E003 WORD FREQUENCY SEARCH REPORT

Classification Analysis:

1. 73/504.12 Total=10 ORs=7 XRs=3
   Class 73 MEASURING AND TESTING
   Sub 488 SPEED, VELOCITY, OR ACCELERATION
   Sub 504.02 .Angular rate using gyroscopic or Coriolis effect
   Sub 504.12 ..Vibratory mass

2. 73/504.16 Total=7 ORs=4 XRs=3
   Class 73 MEASURING AND TESTING
   Sub 488 SPEED, VELOCITY, OR ACCELERATION
   Sub 504.02 .Angular rate using gyroscopic or Coriolis effect
   Sub 504.12 ..Vibratory mass
   Sub 504.15 ...Cantilever
   Sub 504.16 ....Tuning fork

3. 310/370 Total=5 ORs=0 XRs=5
   Class 310 ELECTRICAL GENERATOR OR MOTOR STRUCTURE
   Sub 300 NON-DYNAMOELECTRIC
   Sub 311 .Piezoelectric elements and devices
   Sub 367 ..Piezoelectric element shape
   Sub 370 ..."U" or "tuning fork" shape

4. 333/187 Total=5 ORs=5 XRs=0
   Class 333 WAVE TRANSMISSION LINES AND NETWORKS
   Sub 24 R COUPLING NETWORKS
   Sub 186 .Electromechanical filter
   Sub 187 ..Using bulk mode piezoelectric vibrator

5. 333/200 Total=5 ORs=0 XRs=5
   Class 333 WAVE TRANSMISSION LINES AND NETWORKS
   Sub 24 R COUPLING NETWORKS
   Sub 186 .Electromechanical filter

Sub 200 ..Reed- or fork-type resonators

6. 73/514.18 Total=4 ORs=2 XRs=2
Class 73 MEASURING AND TESTING
Sub 488 SPEED, VELOCITY, OR ACCELERATION
Sub 514.01 .Acceleration determination utilizing inertial element
Sub 514.16 ..Specific type of electric sensor or specific type of magnetic sensor
Sub 514.17 ...Rebalance
Sub 514.18 ....Electrostatic restoring means

7. 216/2 Total=4 ORs=1 XRs=3
Class 216 ETCHING A SUBSTRATE: PROCESSES
Sub 2 ETCHING OF SEMICONDUCTOR MATERIAL TO PRODUCE AN ARTICLE HAVING A NONELECTRICAL FUNCTION

8. 310/309 Total=4 ORs=2 XRs=2
Class 310 ELECTRICAL GENERATOR OR MOTOR STRUCTURE
Sub 300 NON-DYNAMOELECTRIC
Sub 308 .Charge accumulating
Sub 309 ..Electrostatic

9. 438/50 Total=4 ORs=3 XRs=1
Class 438 SEMICONDUCTOR DEVICE MANUFACTURING: PROCESS
Sub 48 MAKING DEVICE OR CIRCUIT RESPONSIVE TO NONELECTRICAL SIGNAL
Sub 50 .Physical stress responsive

10. 73/504.02 Total=3 ORs=1 XRs=2
Class 73 MEASURING AND TESTING
Sub 488 SPEED, VELOCITY, OR ACCELERATION
Sub 504.02 .Angular rate using gyroscopic or Coriolis effect

11. 257/417 Total=3 ORs=1 XRs=2
Class 257 ACTIVE SOLID-STATE DEVICES (E.G., TRANSISTORS, SOLID -STATE DIODES)
Sub 414 RESPONSIVE TO NON-ELECTRICAL SIGNAL (E.G., CHEMICAL, STRESS, LIGHT, OR MAGNETIC FIELD SENSORS)
Sub 415 .Physical deformation
Sub 417 ..Strain sensors

12. 257/419 Total=3 ORs=1 XRs=2
Class 257 ACTIVE SOLID-STATE DEVICES (E.G., TRANSISTORS, SOLID -STATE DIODES)
Sub 414 RESPONSIVE TO NON-ELECTRICAL SIGNAL (E.G., CHEMICAL, STRESS, LIGHT, OR MAGNETIC FIELD SENSORS)
Sub 415 .Physical deformation
Sub 417 ..Strain sensors
Sub 418 ...With means to concentrate stress
Sub 419 ....With thinned central active portion of semiconductor surrounded by thick insensitive portion (e.g., diaphragm type strain gauge)

13. 331/156 Total=3 ORs=0 XRs=3
Class 331 OSCILLATORS
Sub 154 ELECTROMECHANICAL RESONATOR
Sub 156 .Vibrating reed or string type (e.g., tuning fork)

14. 438/456 Total=3 ORs=0 XRs=3
Class 438 SEMICONDUCTOR DEVICE MANUFACTURING: PROCESS
Sub 455 BONDING OF PLURAL SEMICONDUCTOR SUBSTRATES
Sub 456 .Having enclosed cavity

Patent Report:

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Ref  Patent Id  Issue/File   US Class (OR)  Title
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1    05747961   May  5 1998  318/646        Beat frequency motor position
                Oct 11 1995                 detection scheme for tuning fork
                                            gyroscope and other sensors
```

Inventor: Ward; Paul A. et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A tuning fork gyroscope has an in-plane position sensitive pick-off to which an AC or AC+DC bias is applied. Intermodulation is exploited to produce beat-notes between the applied frequency and the motor frequency at amplitudes proportional to motor amplitude, but unaffected by error sources such as spurious substrate charge accumulation. The beat-notes are used to control motor amplitude without the effects of charge accumulation.

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2    05581035   Dec  3 1996  73/514.32      Micromechanical sensor with a
                Aug 29 1994                 guard band electrode
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Inventor: Greiff; Paul
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

An electrostatically actuated micromechanical sensor having a guard band electrode for reducing the effect of transients associated with a dielectric substrate of the sensor. A proof mass, responsive to an input, is suspended over the substrate and one or more electrodes are disposed on the substrate in electrostatic communication with the proof mass to sense the input acceleration and/or to torque the proof mass back to a null position. A guard band electrode is disposed over the dielectric substrate in overlapping relationship with the electrodes and maintains the surface of the substrate at a reference potential, thereby shielding the proof mass from transients and enhancing the accuracy of the sensor.

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3    05646348   Jul  8 1997  73/514.36      Micromechanical sensor with a
                Sep  5 1995                 guard band electrode and
                                            fabrication technique therefor
```

Inventor: Greiff; Paul et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

An electrostatically actuated micromechanical sensor having a guard band electrode for reducing the effect of transients associated with a dielectric substrate of the sensor. A proof mass, responsive to an input,

is suspended over the substrate and one or more electrodes are disposed on the substrate in electrostatic communication with the proof mass to sense the input acceleration and/or to torque the proof mass back to a null position. A guard band electrode is disposed over the dielectric substrate in overlapping relationship with the electrodes and maintains the surface of the substrate at a reference potential, thereby shielding the proof mass from transients and enhancing the accuracy of the sensor. A dissolved wafer process for fabricating the micromechanical sensor is described in which the proof mass is defined by a boron doping step. An alternative fabrication technique is also described in which the proof mass is defined by an epitaxial layer.

4 05492596 Feb 20 1996 438/50 Method of making a micromechanical
Feb 4 1994 silicon-on-glass tuning fork
gyroscope

Inventor: Cho; Steve T.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A micromechanical tuning fork gyroscope fabricated by a dissolved silicon wafer process whereby electrostatic bonding forms a hermetic seal between an etched glass substrate, metal electrodes deposited thereon, and a silicon comb-drive tuning fork gyroscope. The dissolved silicon wafer process involves single sided processing of a silicon substrate, including the steps of etching recesses, diffusing an etch resistant dopant into the silicon substrate, and releasing various components of the silicon gyroscope by etching through the diffusion layer in desired locations. The glass substrate also undergoes single sided processing, including the steps of etching recesses, depositing a multi-metal system in the recesses, and selectively etching portions of the multi-metal system. One substrate is inverted over the other and aligned before anodic bonding of the two substrates is performed.

5 05349855 Sep 27 1994 73/504.16 Comb drive micromechanical tuning
Apr 7 1992 fork gyro

Status: certificate of correction has been issued
Inventor: Bernstein; Jonathan J. et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A microfabricated tuning fork rate sensitive structure and drive electronics in which vibrational forces are communicated through a set of meshing drive and driven finger electrodes associated with each of two vibrating elements. The vibrating elements are supported in a rotatable assembly between first and second support electrodes which are in turn suspended by flexures for rotation about an axis passing through the flexures and through a point midway between the vibrating elements. Additional masses are formed onto the vibrating elements to improve overall sensor sensitivity. Sense electrodes for detecting capacitive changes between the support electrodes and the sense electrodes are positioned at each end of the support electrodes. Drive electronics are connected between the driven fingers of the vibrating elements and the drive electrode fingers which mesh with them to cause vibration. Excitation is provided between the support electrodes and the sense electrodes. Any change in signal resulting from rotation of the assembly and the resulting variation in capacitance between the support electrodes

and the sense electrodes is sensed as a measure of inertial rate. A torque loop may be additionally formed using the sense electrodes in order to re-torque the assembly to a neutral position in a torque-to-balance loop.

6 05496436 Mar 5 1996 438/50 Comb drive micromechanical tuning
Jun 15 1994 fork gyro fabrication method

Inventor: Bernstein; Jonathan J. et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A microfabricated, tuning fork rate sensitive structure and drive electronics in which vibrational forces are communicated through a set of meshing drive and driven finger electrodes associated with each of two vibrating elements. The vibrating elements are supported in a rotatable assembly between first and second support electrodes which are in turn suspended by flexures for rotation about an axis passing through the flexures and through a point midway between the vibrating elements. Additional masses are formed onto the vibrating elements to improve overall sensor sensitivity. Sense electrodes for detecting capacitive changes between the support electrodes and the sense electrodes are positioned at each end of the support electrodes. Drive electronics are connected between the driven fingers of the vibrating elements and the drive electrode fingers which mesh with them to cause vibration. Excitation is provided between the support electrodes and the sense electrodes. Any change in signal resulting from rotation of the assembly and the resulting variation in capacitance between the support electrodes and the sense electrodes is sensed as a measure of inertial rate. A torque loop may be additionally formed using the sense electrodes in order to re-torque the assembly to a neutral position in a torque-to-balance loop.

7 05767405 Jun 16 1998 73/504.16 Comb-drive micromechanical tuning
Jan 11 1996 fork gyroscope with piezoelectric
readout

Inventor: Bernstein; Jonathan J. et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A microfabricated, tuning fork rate sensitive structure and drive electronics in which vibrational forces are communicated through a set of meshing drive and driven finger electrodes associated with each of two vibrating elements. The vibrating elements are supported in a rotatable assembly between first and second support electrodes which are in turn suspended by flexures for rotation about an axis passing through the flexures and through a point midway between the vibrating elements. Additional masses are formed onto the vibrating elements to improve overall sensor sensitivity. Sense electrodes for detecting capacitive changes between the support beams and the substrate are positioned on the substrate beneath each end of the support beams. In an alternative embodiment, piezoelectric sense capacitors are disposed on the flexures for detecting rotation of the support electrodes. Drive electronics are connected between the driven fingers of the vibrating elements and the drive electrode fingers which mesh with them to cause vibration. Excitation is provided between the support electrodes and the sense electrodes. Any change in signal resulting from rotation of the assembly and the resulting variation in capacitance between the support electrodes and the sense electrodes or within the piezoelectric capacitors is sensed

as a measure of inertial rate. A torque loop may be additionally formed using the sense electrodes in order to re-torque the assembly to a neutral position in a torque-to-balance loop.

8 05650568 Jul 22 1997 73/504.09 Gimballed vibrating wheel
May 12 1995 gyroscope having strain relief
features

Inventor: Greiff; Paul et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A gimballed vibrating wheel gyroscope for detecting rotational rates in inertial space. The gyroscope includes a support oriented in a first plane and a wheel assembly disposed over the support parallel to the first plane. The wheel assembly is adapted for vibrating rotationally at a predetermined frequency in the first plane and is responsive to rotational rates about a coplanar input axis for providing an output torque about a coplanar output axis. The gyroscope also includes a post assembly extending between the support and the wheel assembly for supporting the wheel assembly. The wheel assembly has an inner hub, an outer wheel, and spoke flexures extending between the inner hub and the outer wheel and being stiff along both the input and output axes. A flexure is incorporated in the post assembly between the support and the wheel assembly inner hub and is relatively flexible along the output axis and relatively stiff along the input axis. Also provided is a single semiconductor crystal fabrication technique and a dissolved wafer fabrication technique. In one embodiment, the gyroscope includes comb drive electrodes. Also described is a box-shaped strain relief structure for use in the spoke flexures and additional strain relief features.

9 05783973 Jul 21 1998 331/35 Temperature insensitive silicon
Feb 24 1997 oscillator and precision voltage
reference formed therefrom

Inventor: Weinberg; Marc S. et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

Micromachined, thermally insensitive silicon resonators are provided having accuracy equivalent or superior to that of quartz resonators, and are fabricated from a micromechanical, silicon-on-glass process. In one embodiment, such a resonator is realized using a tuning fork gyroscope. Radiation-hard precision voltage references (PVRs) are enabled using the silicon resonators. Thermal sensitivity is reduced relative to that of a silicon-on-silicon process oscillator, providing a thermal sensitivity comparable to that of a quartz oscillator. By employing a micromechanical device based upon a tuning fork gyroscope, resonators are made from either or both of the gyro drive and sense axes. A resonator constructed as an oscillator loop whose resonant frequency is compared to a frequency standard provides a bias voltage as a reference voltage.

10 05373267 Dec 13 1994 333/187 Piezoelectric resonator device of
Jul 23 1992 tuning fork type

Inventor: Kaida; Hiroaki et al.
Assignee: Murata Manufacturing Co., Ltd.
Abstract:

Disclosed is a piezoelectric resonator device. This piezoelectric

resonator device comprises a piezoelectric substrate having an almost rectangular plane shape. The piezoelectric substrate is provided with a slit extending to the inside from one edge of the piezoelectric substrate, for forming a tuning fork portion, and a pair of slits for separating the tuning fork portion, spaced apart from the slit forming the tuning fork portion by a predetermined distance on both sides of the slit forming the tuning fork portion, and approximately parallel with the slit forming the tuning fork portion. Vibrating electrodes are formed on both major surfaces of the piezoelectric substrate at a piezoelectric vibrating portion, between the slits separating the tuning fork portion from non-vibrating portions of the substrate.

11 05644273 Jul 1 1997 333/187 Piezoelectric resonator device of
Jun 7 1995 tuning fork type
Inventor: Kaida; Hiroaki et al.
Assignee: Murata Manufacturing Co., Ltd.
Abstract:

Disclosed is a piezoelectric resonator device. This piezoelectric resonator device comprises a piezoelectric substrate having an almost rectangular plane shape. The piezoelectric substrate is provided with a slit extending to the inside from one edge of the piezoelectric substrate, for forming a tuning fork portion, and a pair of slits for separating the tuning fork portion, spaced apart from the slit forming the tuning fork portion by a predetermined distance on both sides of the slit forming the tuning fork portion, and approximately parallel with the slit forming the tuning fork portion. Vibrating electrodes are formed on both major surfaces of the piezoelectric substrate at a piezoelectric vibrating portion, between the slits separating the tuning fork portion from non-vibrating portions of the substrate.

12 05373269 Dec 13 1994 333/187 Piezoelectric resonator device of
May 12 1993 tuning fork type including a
spacer member
Inventor: Kaida; Hiroaki et al.
Assignee: Murata Manufacturing Co., Ltd.
Abstract:

Disclosed is a piezoelectric resonator device. This piezoelectric resonator device comprises a piezoelectric substrate having an almost rectangular plane shape. The piezoelectric substrate is provided with a slit extending to the inside from one edge of the piezoelectric substrate, for forming a tuning fork portion, and a pair of slits for separating the tuning fork portion, spaced apart from the slit forming the tuning fork portion by a predetermined distance on both sides of the slit forming the tuning fork portion, and approximately parallel with the slit forming the tuning fork portion. Vibrating electrodes are formed on both major surfaces of the piezoelectric substrate at a piezoelectric vibrating portion between the slits separating the tuning fork portion from non-vibrating portions of the substrate.

13 05159301 Oct 27 1992 333/187 Piezoelectric resonator device of
Nov 3 1989 the tuning fork type
Inventor: Kaida; Hiroaki et al.
Assignee: Murata Manufacturing Co., Ltd.
Abstract:

Disclosed is a piezoelectric resonator device. This piezoelectric resonator device comprises a piezoelectric substrate having an almost rectangular plane shape. The piezoelectric substrate is provided with a slit extending to the inside from one edge of the piezoelectric substrate, for forming a tuning fork portion, a pair of slits for separating the tuning fork portion, spaced apart from the slit forming a tuning fork portion by a predetermined distance on both sides of the slit forming the tuning fork portion, and approximatelyy parallel with the slit forming a tuning fork portion. Vibrating electrodes are formed on both major surfaces of the piezoelectric substrate at a piezoelectric vibrating portion, between the slits separating the tuning fork portion from non-vibrating portions of the substrate.

14 05747690 May 5 1998 73/504.12 Vibratory microgyroscope
Dec 26 1996
Inventor: Park; Kyu-yeon et al.
Assignee: Samsung Electronics Co., Ltd. et al.
Abstract:
A microgyroscope includes a substrate, a vibratory structure having two stripe portions, a plurality of connection portions, and a comb, an elastic member for elastically maintaining the vibratory structure, a driver for applying the vibratory structure, a sensor for sensing the one directional action of the vibratory structure, and a plurality of sensing electrodes for sensing displacement by Coriolis force.

15 05530342 Jun 25 1996 324/158.1 Micromachined rate sensor comb drive device and method
Sep 30 1994
Inventor: Murphy; Hugh J.
Assignee: Rockwell International Corporation
Abstract:
A micromachined rate sensor system includes plural sensing proof masses or plates coupled to multiple electrostatic combs. A comb drive amplifier induces a deflection of the sense plates along a plane defined by the configuration of the sense plates, such that the sensed rotational rate causes an out-of-plane force to act on the sense plates. The motor combs are driven at half NRF by coupling a comb drive amplifier to a half frequency motor oscillator comprising a digital "divide by 2" flip flop, a low pass filter, a multiplier, and a plurality of signal amplifiers. The half frequency oscillator provides the drive voltage at one-half the NRF. Accordingly, embodiments of the present invention eliminate undesirable parasitic drive feedthrough at the motor frequency, thus providing for increased efficiency.

16 05501103 Mar 26 1996 73/514.29 Two-port electromagnetic drive for a double-ended tuning fork
Feb 15 1994
Inventor: Woodruff; James R. et al.
Assignee: AlliedSignal Inc.
Abstract:
An electromagnetically-excited silicon micromachined vibrating beam accelerometer includes a proof mass or pendulum attached to an outer casing by way of a pair of flexures defining a hinge axis HA. A double-ended tuning fork (DETF) is connected between the proof mass and the casing along an axis generally perpendicular to the hinge axis (HA) defining a sensitive axis SA such that forces applied along the hinge axis

HA will cause the DETF to go into either compression or tension. Electromagnetic excitation causes the vibrating beams to vibrate at a resonant frequency when the proof mass is at rest. In response to a force along the sensitive axis SA, the vibrating beams go into either tension or compression resulting in a change in the resonant frequency which, in turn, is used as a measure of the force. The excitation includes a magnetic field B, applied in a direction generally perpendicular to the plane of the DETF and perpendicular to the sensitive axis SA. In order to eliminate the effects of variations in the resistance path of the vibrating beams due to either manufacturing tolerances and temperature, the DETF in accordance with the present invention is formed as a dual-port device with separate conducting paths for the drive circuit and the pick-off circuit. By providing separate conducting paths, the effects of changes in the resistance path of the drive circuit have little effect on the overall performance of the oscillator. Since the beams are separated, the DETFs are configured to provide sufficient mechanical coupling of the beams forming the DETF.

17 05361635 Nov 8 1994 73/514.18 Multiple servo loop accelerometer
Apr 12 1993 with tunnel current sensors

Inventor: Woodruff; James R.
Assignee: AlliedSignal Inc.
Abstract:

A servo accelerometer permits compliant suspension with a pair of flexures by using a plurality of tunnel current position sensors each respectively associated with a corresponding pair of electrostatic drive electrodes. The tunnel current position sensors and the electrostatic drive electrodes are positioned to control undesired movement of the proof mass about a first axis which is normal to the input axis of the accelerometer. In another embodiment, three tunnel current sensors and three pairs of drive electrodes are used to control movement of the proof mass about the first axis and a second axis.

18 05756895 May 26 1998 73/504.15 Tunneling-based rate gyros with
Sep 1 1995 simple drive and sense axis coupling

Inventor: Kubena; Randall L. et al.
Assignee: Hughes Aircraft Company
Abstract:

Various structures for cantilever beam tunneling rate gyro devices formed on a single substrate are disclosed. A cantilever electrode having a plurality of portions extending from the substrate with one end of the cantilever is suspended above the substrate at a distance from a tunneling electrode so that a tunneling current flows through the cantilever and tunneling electrode in response to an applied bias voltage. The cantilever and tunneling electrodes form a circuit that produces an output signal. A force applied to the sensor urges the cantilever electrode to deflect relative to the tunneling electrode to modulate the output signal. The output signal is a control voltage that is applied between the cantilever electrode and a control electrode to maintain a constant tunneling current. In the preferred embodiment, two cantilever portions extend from the wafer surface forming a Y-shape. In a further embodiment, a strap is fabricated on the cantilever electrode. In an alternate embodiment, a ridge emitter is formed such that it remains under the cantilever

electrode during lateral motion of the cantilever In an alternate embodiment, a cantilever having a varying width is fabricated.

19 05605598 Feb 25 1997 438/50 Monolithic micromechanical
May 13 1994 vibrating beam accelerometer with
trimmable resonant frequency

Inventor: Greiff; Paul
Assignee: The Charles Stark Draper Laboratory Inc.
Abstract:

A monolithic, micromechanical vibrating beam accelerometer with a trimmable resonant frequency is fabricated from a silicon substrate which has been selectively etched to provide a resonant structure suspended over an etched pit. The resonant structure comprises an acceleration sensitive mass and at least two flexible elements having resonant frequencies. Each of the flexible elements is disposed generally collinear with at least one acceleration sensitive axis of the accelerometer. One end of at least one of the flexible elements is attached to a tension relief beam for providing stress relief of tensile forces created during the fabrication process. Mass support beams having a high aspect ratio support the mass over the etched pit while allowing the mass to move freely in the direction collinear with the flexible elements. Also disclosed is a method for fabricating such an accelerometer. Further disclosed is an alternative embodiment of the aforementioned accelerometer characterized by a low profile, and alternative planar processing methods for fabrication of these and other embodiments.

20 05760305 Jun 2 1998 73/514.15 Monolithic micromechanical
Feb 20 1996 vibrating beam accelerometer with
trimmable resonant frequency

Inventor: Greiff; Paul
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A monolithic, micromechanical vibrating beam accelerometer with a trimmable resonant frequency is fabricated from a silicon substrate which has been selectively etched to provide a resonant structure suspended over an etched pit. The resonant structure comprises an acceleration sensitive mass and at least two flexible elements having resonant frequencies. Each of the flexible elements is disposed generally collinear with at least one acceleration sensitive axis of the accelerometer. One end of at least one of the flexible elements is attached to a tension relief beam for providing stress relief of tensile forces created during the fabrication process. Mass support beams having a high aspect ratio support the mass over the etched pit while allowing the mass to move freely in the direction collinear with the flexible elements. Also disclosed is a method for fabricating such an accelerometer. Further disclosed is an alternative embodiment of the aforementioned accelerometer characterized by a low profile, and alternative planar processing methods for fabrication of these and other embodiments.

21 05359893 Nov 1 1994 73/504.12 Multi-axes gyroscope
Dec 19 1991

Inventor: Dunn; William C.
Assignee: Motorola, Inc.
Abstract:

A vibration gyroscope with a mass mounted for vibrational movement on a central post. Sensing capacitors are mounted adjacent the mass for sensing vibrational movement in two perpendicular axes. The mass includes a pair of elements mounted between the parallel arms of an H shaped frame and powered for equal and opposite vibrations so that no movement is imparted to the frame except that caused by forces induced by rotational movement.

22 05408877 Apr 25 1995 73/504.12 Micromechanical gyroscopic
Mar 16 1992 transducer with improved drive and sense capabilities

Inventor: Greiff; Paul et al.

Assignee: The Charles Stark Draper Laboratory, Inc.

Abstract:

A double gimbal micromachined gyroscopic transducer is provided in a substrate having a pit extending downwardly from a top surface of the substrate. A gyroscopic transducer element suspended above the pit comprises an outer sense gimbal plate integral with the substrate, coupled to the substrate by a pair of flexible elements attached to opposite ends of the plate. The flexible elements are axially aligned to permit oscillatory motion about a sense axis passing through the flexible elements. The gyroscopic transducer further includes an inner drive gimbal plate integral with and interior to the sense gimbal plate. The drive gimbal plate is coupled to the sense gimbal plate by a second pair of flexible elements along an axis orthogonal to the first pair of flexible elements. The drive gimbal plate also includes a balanced mass generally centrally located on the drive gimbal plate. Also included are drive and sense electronics, for energizing the drive gimbal plate to oscillate about the drive axis, and for sensing any movement of the sense gimbal plate indicative of an angular rate about an input axis. The sense electronics includes a sense electrode disposed so as not to be in close proximity to and interfere with free oscillatory motion of the drive gimbal plate.

23 05515724 May 14 1996 73/504.12 Micromechanical gyroscopic
Apr 20 1995 transducer with improved drive and sense capabilities

Inventor: Greiff; Paul et al.

Assignee: The Charles Stark Draper Laboratory, Inc.

Abstract:

A double gimbal micromachined gyroscopic transducer is provided in a substrate having a pit extending downwardly from a top surface of the substrate. A gyroscopic transducer element suspended above the pit comprises an outer sense gimbal plate integral with the substrate, coupled to the substrate by a pair of flexible elements attached to opposite ends of the plate. The flexible elements are axially aligned to permit oscillatory motion about a sense axis passing through the flexible elements. The gyroscopic transducer further includes an inner drive gimbal plate integral with and interior to the sense gimbal plate. The drive gimbal plate is coupled to the sense gimbal plate by a second pair of flexible elements along an axis orthogonal to the first pair of flexible elements. The drive gimbal plate also includes a balanced mass generally centrally located on the drive gimbal plate. Also included are drive and sense electronics, for energizing the drive gimbal plate to oscillate

about the drive axis, and for sensing any movement of the sense gimbal plate indicative of an angular rate about an input axis. The sense electronics includes a sense electrode disposed so as not to be in close proximity to and interfere with free oscillatory motion of the drive gimbal plate.

24 05377545 Jan 3 1995 73/514.18 Servo accelerometer with tunnel
Dec 8 1992 current sensor and complementary
electrostatic drive

Inventor: Norling; Brian L. et al.
Assignee: AlliedSignal Inc.
Abstract:

A servo accelerometer uses a tunnel current sensor having a first sensing electrode coupled in fixed alignment with a frame and a second sensing electrode coupled to a proof mass. A position sensing circuit develops a sensing signal indicative of displacement of the proof mass. A feedback circuit provides an output signal and provides a feedback signal to electrostatic drive electrodes for applying an electrostatic repositioning force to the proof mass. The proof mass and frame are connected by a highly compliant suspension structure.

25 05572057 Nov 5 1996 257/417 Semiconductor acceleration sensor
Dec 21 1994 with movable electrode

Inventor: Yamamoto; Toshimasa et al.
Assignee: Nippondenso Co., Ltd.
Abstract:

Adverse effects due to electrostatic force between a semiconductor substrate and a movable electrode are avoided with a new structure. A movable electrode of beam structure is disposed at a specified interval above a p-type silicon substrate. Fixed electrodes, each composed of an impurity diffusion layer, are disposed on both sides of the movable electrode on the p-type silicon substrate; these fixed electrodes are self-aligningly with respect to the movable electrode. The movable electrode is displaced in accompaniment to the action of acceleration, and acceleration is detected by change (fluctuation) in current between the fixed electrodes generated by means of this displacement. Additionally, an electrode for movable electrode upward-movement use is disposed above the movable electrode, a potential difference is given between the movable electrode and the electrode for movable electrode upward-movement use, and attractive force of the movable electrode to the silicon substrate is alleviated.

26 05505084 Apr 9 1996 73/504.14 Micromechanical tuning fork
Mar 14 1994 angular rate sensor

Inventor: Greiff; Paul et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A, micromechanical tuning fork gyroscope is fabricated from a unitary silicon substrate utilizing etch stop diffusions and selective anisotropic etching. A silicon structure is suspended over the selectively etched pit. The silicon structure includes at least first and second vibratable structures. Each vibratable structure is energizable to vibrate laterally along an axis normal to the rotation sensitive axis. The lateral vibration of the first and second vibratable structures effects simultaneous

vertical movement of at least a portion of the silicon structure upon the occurrence of angular rotation of the gyroscope about the rotation sensitive axis. The vertical movement of the silicon structure is sensed, and a voltage proportional to the movement is generated, for providing an indication of angular rate of rotation detected by the gyroscope.

27 05545594 Aug 13 1996 438/51 Semiconductor sensor anodic-bonding process, wherein bonding of corrugation is prevented
Oct 26 1993

Inventor: Cahill; Sean S.
Assignee: Yazaki Meter Co., Ltd.
Abstract:

A method for bonding a silicon substrate and a glass substrate through an anodic-bonding process, including steps of: forming at least two holes in the glass substrate; forming a recess on the glass substrate, the recess confronting an undesired bonding portion defined in the silicon substrate; depositing a metal layer on the glass substrate with a predetermined pattern; depositing a dielectric layer on the metal layer, the insulating layer covering substantially the entire surface of the metal layer; and bonding the glass substrate and the semiconductor material.

28 05666258 Sep 9 1997 361/207 Micromechanical relay having a hybrid drive
Aug 17 1995

Inventor: Gevatter; Hans-Jurgen et al.
Assignee: Siemens Aktiengesellschaft
Abstract:

PCT No. PCT/DE94/00152 Sec. 371 Date Aug. 17, 1995 Sec. 102(e) Date Aug. 17, 1995 PCT Filed Feb. 14, 1994 PCT Pub. No. WO94/19819 PCT Pub. Date Aug. 1, 1994

A micromechanical relay is provided having a cantilevered armature (53) which is etched out from an armature substrate (52). The armature is in the form of a tongue, is elastically connected to the armature substrate, and forms an electrostatic drive with a base electrode (58) of a base substrate (51) located underneath. In addition, a piezo-layer (60) is provided on the armature (53). The piezo-layer (60) acts as a bending transducer and forms a supplemental actuator for a quick response time. When a voltage is applied to the electrodes of the armature (53), base substrate (51) and piezo-layer (60), the armature is attracted toward the base substrate and then rests over a large area on the base, closing at least one contact (55, 56). The different characteristics of the electrostatic actuator, on the one hand, and of the piezo-drive, on the other hand, are complementarily combined to provide a strong attraction force at the start of the armature movement, and a strong contact force is produced after the armature has been attracted.

29 05543106 Aug 6 1996 264/430 Method of polarizing piezoelectric ceramic substrate
Dec 28 1994

Inventor: Nakashima; Mikio
Assignee: Murata Manufacturing Co., Ltd.
Abstract:

A plurality of polarization electrodes are provided oppositely on front and back surfaces of a piezoelectric ceramic substrate, while the polarization electrodes on the front surface and the polarization

electrodes on the back surface are connected respectively by connecting electrodes which are formed on positions not opposed to each other. A dc voltage is applied across the polarization electrodes on the front and back surfaces for polarizing the substrate to form a plurality of polarized portions in the substrate. Thus, it is possible to reduce stress concentration in polarizing process, thereby inhibiting the substrate from cracking.

30 05635639 Jun 3 1997 73/504.04 Micromechanical tuning fork
Jun 7 1995 angular rate sensor

Inventor: Greiff; Paul et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A micromechanical tuning fork gyroscope includes a suspended structure comprising at least first and second vibratable structures. Each vibratable structure is energizable to vibrate laterally, within a first plane, along an axis normal to the rotation sensitive axis. The lateral or inplane vibration of the first and second vibratable structures effects simultaneous vertical or rotational movement of at least a portion of the suspended structure upon the occurrence of angular rotation of the gyroscope about the rotation sensitive axis. Vertical or rotational movement of the suspended structure is sensed, and a voltage proportional to the movement is generated, for providing an indication of angular rate of rotation detected by the gyroscope.

31 05554304 Sep 10 1996 216/2 Process for producing a
Mar 24 1995 micromotion mechanical structure

Inventor: Suzuki; Kenichiro
Assignee: Nec Corporation
Abstract:

In a micromotion mechanical structure, such as a vibration-type sensor or a step motor, comprising at least one fixed electrode and at least one movable electrode which is moved by electrostatic power applied to the fixed electrode, at least one of the electrodes is formed essentially by a single crystal semiconductor material. The single crystal semiconductor material has various merits of uniform mechanical properties, small internal stress, etc. for use in such electrodes. Such structure has been realized by attaching patterned electrode made of the material to another substrate and then removing or thinning the original substrate carrying the patterned electrodes.

32 05428259 Jun 27 1995 310/309 Micromotion mechanical structure
Apr 20 1993 and a process for the production
thereof

Inventor: Suzuki; Kenichiro
Assignee: NEC Corporation
Abstract:

In a micromotion mechanical structure, such as a vibration-type sensor or a step motor, comprising at least one fixed electrode and at least one movable electrode which is moved by electrostatic power applied to the fixed electrode, at least one of the electrodes is formed essentially by a single crystal semiconductor material. The single crystal semiconductor material has various merits of uniform mechanical properties, small internal stress, etc. for use in such electrodes. Such structure has been

realized by attaching patterned electrode made of the material to another substrate and then removing or thinning the original substrate carrying the patterned electrodes.

33 05388458 Feb 14 1995 73/504.16 Quartz resonant gyroscope or
Nov 24 1992 quartz resonant tuning fork gyroscope

Inventor: Weinberg; Marc S. et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A resonantly vibrating or tuning fork rate sensor in which a quartz beam is instrumented with electrodes in first and second regions forming respective sense and drive electrodes wherein the piezoelectric resonance affect of the quartz material between the drive electrodes is used as a tuning element for an oscillator circuit. The electrodes are driven in a balanced voltage mode and sensed in a common mode rejection differential amplifier while leads running to the electrodes along the quartz beam are placed at positions of minimal field strength for improving the signal to noise ratio of the device. The rate sensor utilizes a multi-electrode pattern in order to make such lead placement possible. The sense pattern and drive pattern may be either in one orientation with the drive electrodes proximate to the body of the quartz resonator or in a second pattern with the sense electrodes proximate to the body. Both the drive electrodes and the sense electrodes operate on the piezoelectric principal, utilizing constriction to induce vibration from the drive electrodes and sensing the current generated from piezoelectric effect resulting from the vibrational compression which occurs out of the plane of vibration during inertial rate input. Alternatively, a capacitive electrode structure may be utilized as a pick-off.

34 03906359 Sep 16 1975 324/252 Magnetic field sensing CCD device
Aug 6 1973 with a slower output sampling rate than the transfer rate yielding an integration

Inventor: Blaha; Franklyn C. et al.
Assignee: Westinghouse Electric Corporation
Abstract:

A charge coupled device is disclosed for sensing magnetic fields, and including a semiconductor substrate covered by a dielectric layer, a source for injecting carriers into the substrate, a plurality of electrodes disposed across the exposed surface of the dielectric layer, drive voltage sources for applying varying voltages to adjacent electrodes whereby "potential wells" are formed under selected electrodes and are moved across the substrate to a plurality of output electrodes. The substrate is placed in a magnetic field to be detected, whereby the path of the carriers through the substrate is deflected according to the strength and direction of the magnetic field. As a result, the distribution of carriers within the semiconductor substrate is uneven and the output derived from the electrodes varies in magnitude according to the direction and strength of the magnetic field. The shape and size of the electrodes is increased between the source of carriers and the output electrodes to permit the carrier displacement under the influence of the sensed magnetic field. The last electrode includes a plurality of fingers or other isolating means for defining the flow of carriers directed

therepast to the output electrodes.

35 04443830 Apr 17 1984 361/275.3 CR Composite part provided with
Mar 30 1983 discharge gap
Inventor: Kaneko; Toshimi et al.
Assignee: Murata Manufacturing Co., Ltd.
Abstract:

The disclosure is directed to an improved CR composite part provided with a discharge gap, in which discharge electrodes are provided on opposite surfaces of a substrate formed with a CR composite circuit, while an opening is provided between confronting forward ends of the discharge electrodes on the respective surfaces of the substrate, so that electrical discharge between both of the discharge electrodes is effected through the space for the opening so as to prevent adhesion of foreign matters between the discharge electrodes and also, to effectively obstruct formation of undesirable stray capacitance for stable discharging characteristics.

36 05796001 Aug 18 1998 73/504.16 Monolithic micromechanical tuning
Jun 7 1995 fork angular rate sensor
Inventor: Greiff; Paul et al.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

A monolithic, micromechanical tuning fork gyroscope is fabricated from a unitary silicon substrate utilizing etch stop diffusions and selective anisotropic etching. A non-etched silicon structure is suspended over the selectively etched pit. The non-etched silicon structure includes at least first and second vibratable structures. Each vibratable structure is energizable to vibrate laterally along an axis normal to the rotation sensitive axis. The lateral vibration of the first and second vibratable structures effects simultaneous vertical movement of at least a portion of the non-etched silicon structure upon the occurrence of angular rotation of the gyroscope about the rotation sensitive axis. The vertical movement of the non-etched silicon structure is sensed, and a voltage proportional to the movement is generated, for providing an indication of angular rate of rotation detected by the gyroscope.

37 05528070 Jun 18 19996 257/419 Semiconductor sensor manufactured
Oct 6 1994 through anodic-bonding process
Inventor: Cahill; Sean S.
Assignee: Yazaki Meter Co., Ltd.
Abstract:

A semiconductor sensor comprising a semiconductor substrate and a glass substrate. The semiconductor substrate includes a support member having an opening centrally defined therein, a diaphragm positioned in the opening of the support member, and a flexible supporting means for supporting and coupling the diaphragm and the support member. The glass substrate includes a portion facing the diaphragm and the supporting means and at least one recess defined in this portion which faces the entirety of the supporting means. The glass substrate also includes a metal layer deposited on a surface of the glass substrate and a dielectric layer deposited on the metal layer such that the dielectric layer faces the diaphragm.

38 05275055 Jan 4 1994 73/778 Resonant gauge with microbeam

Aug 31 1992 driven in constant electric field
Status: certificate of correction has been issued
Inventor: Zook; James D. et al.
Assignee: Honeywell Inc.
Abstract:

A resonant strain gauge includes a silicon substrate, a polysilicon flexure beam attached at both ends to the substrate, and a polysilicon rigid cover cooperating with the substrate to enclose the flexure beam within a sealed vacuum chamber. An upper bias electrode is formed on the cover, and a lower bias electrode is formed on the substrate directly beneath and spaced apart from the flexure beam. A drive electrode is formed in or on the beam, centered between the upper and lower bias electrodes transversely with respect to the direction of beam elongation. The upper and lower electrodes are biased at constant voltage levels, of equal magnitude and opposite polarity. The drive electrode, ordinarily biased at ground, is selectively charged by applying an oscillating drive voltage, to cause mechanical oscillation of the beam. A piezoresistor element, formed on the beam, senses beam oscillation and provides a position indicating input to the oscillator circuit that drives the beam. The beam tends to oscillate at its natural resonant frequency. The piezoresistor thus provides the natural resonant frequency to the oscillating circuit, adjusting the frequency of the beam drive signal toward coincidence with the natural resonant frequency. A shield electrode can be formed on the flexure beam between the piezoresistor and the drive electrode, to insure against parasitic capacitance. In alternative embodiments, the drive signal is applied to one of the bias electrodes to oscillate the beam, and beam oscillation is sensed capacitively.

39 05434547 Jul 18 1995 333/187 Tuning fork type piezoelectric
Jun 9 1992 resonator having steps formed in arms of the tuning fork
Inventor: Kaida; Hiroaki et al.
Assignee: Murata Manufacturing Co., Ltd.
Abstract:

A tuning fork type piezoelectric resonator constructed by forming tuning fork arm portions on both sides of a first slit provided for a piezoelectric substrate, forming resonance electrodes on both major surfaces of the piezoelectric substrate in a region around the first slit, and forming steps in outer edges of the tuning fork arm portions.

40 05640133 Jun 17 1997 333/197 Capacitance based tunable
Jun 23 1995 micromechanical resonators
Inventor: MacDonald; Noel C. et al.
Assignee: Cornell Research Foundation, Inc.
Abstract:

A tunable electromicromechanical resonator structure incorporates an electrostatic actuator which permits reduction or enhancement of the resonant frequency of the structure. The actuator consists of two sets of opposed electrode fingers, each set having a multiplicity of spaced, parallel fingers. One set is mounted on a movable portion of the resonator structure and one set is mounted on an adjacent fixed base on substrate, with the fingers in opposed relationship and their adjacent ends spaced apart by a gap. An adjustable bias voltage across the sets of electrodes adjusts the resonant frequency of the movable structure.

41 05506553 Apr 9 1996 333/204 High-frequency filter
Oct 18 1994
Inventor: Makita; Takashi et al.
Assignee: Murata Manufacturing Co., Ltd.
Abstract:
One example of a high-frequency filter includes a dielectric substrate having a high dielectric constant. On one whole main face of the dielectric substrate, an earth electrode is formed. On the other main face of the dielectric substrate, two pattern electrodes are formed. The pattern electrodes have first parts formed in parallel at an interval, and second parts extended in crossing (non-parallel) directions. Also, on one main face of the dielectric substrate, input-output electrodes are respectively formed near the end parts of the pattern electrodes, and capacitors are respectively formed between the open end parts and the input-output electrodes.

42 05508727 Apr 16 1996 347/112 Apparatus and method for pattern generation on a dielectric substrate
Sep 14 1994
Inventor: Zur; Albert
Assignee: Imagine, Ltd.
Abstract:
Apparatus for pattern generation on a dielectric substrate including a drum having an outer pattern receiving and retaining dielectric substrate, a plurality of electrodes mounted in the drum and being arranged so as to underlie the outer pattern receiving and retaining dielectric substrate, imagewise voltage supply circuitry for imagewise application of voltage to the plurality of electrodes, and an elongate ion source operative to apply a flow of charges to the dielectric substrate in a non-imagewise manner.

43 05656777 Aug 12 1997 73/504.12 Miniature box vibrating gyroscope
Jun 13 1996
Inventor: Petri; Fred et al.
Assignee: AlliedSignal, Inc.
Abstract:
An open top box structure is micromachined on a base, such as a crystalline silicon substrate, and drive and sensing devices are fabricated on the same substrate. Output transducers sense Coriolis force changes by processing signals representing force components at the corners of the vibrating box structure as it is rotated to yield angular rate measurement.

44 05635640 Jun 3 1997 73/504.12 Micromachined device with rotationally vibrated masses
Jun 6 1995
Inventor: Geen; John A.
Assignee: Analog Devices, Inc.
Abstract:
A micromachined device has a plurality of rotationally dithered masses that are used to sense acceleration. To eliminate common modes, the masses are dithered in an equal and opposite manner. To help maintain this relationship between the movement of the masses, a coupling fork provides minimal resistance to anti-phase movement and substantial resistance to in-phase movement. Electrodes are used to detect changes in capacitance

between the masses and the substrate resulting from rotation of the device about a radial axis of a mass. These electrodes are electrically connected to eliminate gradients that are caused by external forces and manufacturing differences. Four masses or more can be provided, arranged in a two-dimensional array, such as a square or hexagon with a coupling fork provided between each pair of masses, and with electrodes connected to eliminate gradients.

45 04962441 Oct 9 1990 361/234 Isolated electrostatic wafer blade
Apr 10 1989 clamp
Inventor: Collins; Kenneth S.
Assignee: Applied Materials, Inc.
Abstract:

An electrostatic-clamping robotic-type semiconductor wafer-holding blade designed to optimize the electrostatic clamping force and decrease the required clamping voltage. The wafer blade includes: a base; interleaved electrodes formed on the base, alternating electrodes being connected in common electrically; and preferably a layer of dielectric material such as Al2O3 having a thickness ranging between 2 mils and 15 mils disposed over the interleaved electrodes and the base to minimize the applied voltage necessary to flatten the wafer against the blade, without dielectric breakdown. The ratio of electrode width to the distance between electrodes ranges from 3/1 to 2/1 to optimize the electrostatic clamping force exerted by the blade.

46 05763903 Jun 9 1998 257/186 Avalanche photodiode for light
Aug 17 1995 detection
Inventor: Mandai; Masaaki et al.
Assignee: Seiko Instruments Inc.
Abstract:

An avalanche photodiode for detecting x-rays and other radiation comprises a first substrate having a portion removed therefrom, a first insulating film formed on the first substrate, a second substrate comprising a floating zone silicon semiconductor substrate disposed on the first insulating film, an impurity region selectively formed in the second substrate at a surface corresponding to the removed portion, a PN junction formed on the second substrate, a glass substrate mounted to the second substrate, a first electrode formed on the first substrate for applying a voltage to the impurity region, a second electrode formed on the second substrate for applying a voltage to the second substrate, a third electrode formed on the glass substrate and electrically connected to the second electrode, and an integrated circuit package having a lead pin connected to the third electrode. Accordingly, a shallow depletion layer may be provided on a floating zone SOI substrate. The substrates may be joined to the glass substrate using a eutectic bonding process.

47 05086010 Feb 4 1992 438/75 Method for manufacturing solid
Apr 16 1991 state image sensing device formed
of charge coupled devices on side
surfaces of trenches
Inventor: Kimura; Mikihiro
Assignee: Mitsubishi Denki Kabushiki Kaisha
Abstract:

A solid state image sensing device comprises photoelectric converting

portions (8) and charge coupled portions. A plurality of parallel trenches (2) are formed on a main surface of a semiconductor substrate (1). Photoelectric converting portions are on the surfaces of the semiconductor substrate on both sides of each of the trenches. Charge transfer portions corresponding to the photoelectric converting portions are independently formed on the side surfaces of the trenches. Insulating and isolating regions (15, 29, 30) are formed on the bottom portions of the trenches. By providing two independent charge transfer portions in one trench, the area occupied by the charge transfer portions can be reduced.

48 05753817 May 19 1998 73/504.12 Microgyroscope with vibratory
Dec 26 1996 structure having a multitude of grooves

Inventor: Park; Kyu-yeon et al.
Assignee: Samsung Electronics Co., Ltd. et al.
Abstract:

A microgyroscope includes a substrate, a first sensor where a plurality of stripe-shaped anodes and cathodes are alternatively arrayed in parallel on the substrate, a driver arranged to be perpendicular to a stripe length direction of the first sensor on the substrate and where a plurality of stripe-shaped anodes and cathodes are alternatively arrayed in parallel, a vibratory structure having a plurality of first grooves of a stripe shape vertically spaced from a plane of the first sensor and the driver at a predetermined height and formed in a direction congruous with a stripe length direction of first sensor and a plurality of second grooves of a stripe shape formed in a direction congruous with a stripe length direction of the driver, a support portion formed on the substrate for maintaining the vibratory structure from the substrate at a predetermined height, and elastic members for elastically connecting the vibratory structure and the support portion.

49 05789843 Aug 4 1998 310/309 Electrostatically levitated
Oct 30 1995 conveyance apparatus and electrode thereof for electrostatic levitation

Inventor: Higuchi; Toshiro et al.
Assignee: Kanagawa Academy of Science and Technology et al.
Abstract:

PCT No. PCT/JP95/00470 Sec. 371 Date Oct. 30, 1995 Sec. 102(e) Date Oct. 30, 1995 PCT Filed Mar. 17, 1995 PCT Pub. No. WO95/25689 PCT Pub. Date Sep. 28, 1995

An electrostatic levitating electrode (10) is split into four equal segments on a circular insulating substrate (4) with isolating strips (11a, 11b) interposed between them. A positive voltage and a negative voltage are alternately applied to these four electrodes (10a, 10b, 10c, 10d), which are sector-shaped. In order to prevent the concentration of electric charge in such case, the corner portions of the sector-shaped electrodes (10a, 10b, 10c, 10d) are formed to have roundness (13). Furthermore, a lead wire (12a) is connected to the outer side of the sector-shaped electrode (10a), a lead wire (12b) is connected to the outer side of the sector-shaped electrode (10b), a lead wire (12c) is connected to the outer side of sector-shaped electrode (10c), and a lead wire (12d) is connected to the outer side of sector-shaped electrode (10d). Accordingly, the maximum attraction force and levitational rigidity are

increased without damage to electrodes at lead portions and it possible to convey a levitated body with accuracy.

50 05703292 Dec 30 1997 73/504.02 Sensor having an off-frequency
Apr 19 1995 drive scheme and a sense bias
generator utilizing tuned circuits

Inventor: Ward; Paul A.
Assignee: The Charles Stark Draper Laboratory, Inc.
Abstract:

Electronics for use in Coriolis and other sensors for reducing errors in the sensor output signal. The electronics includes an off-frequency drive scheme for reducing in-band drive signal coupling to the output signal and techniques for reducing errors in the sensor output signal due to quadrature and phase shift. The off-frequency drive scheme includes a frequency translation circuit in the excitation feedback loop of a sensor system to suppress components of the sensor drive signal at a predetermined frequency so that coupling of the drive signal to the sensor output signal can be readily removed by conventional filtering techniques. The sensor system includes a nonlinear input transducer for converting the drive signal to a force signal such that the force signal has a component at the predetermined frequency while the drive signal does not. A tuned circuit amplifies and filters the frequency shifted output signal of the translation circuit to provide the drive signal. Also provided is a sense bias generator including a tuned circuit for amplifying the available bias supply voltage to enhance sensitivity.

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